The Coastal Ocean Processes (CoOP) Planning and Management

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LONG-TERM GOALS

The goal of CoOP is to advance our quantitative understanding of the processes and interactions among the processes that determine the characteristics of coastal systems including the cross-shelf transports, transformations and fates of biologically, chemically and geologically important materials. The CoOP Program implements multi-investigator, interdisciplinary research in the coastal ocean which encompasses the disciplines of Biological, Chemical, Geological and Physical Oceanography plus Marine Meteorology.

OBJECTIVES

CoOP's underlying scientific planning assumption is that a series of well designed, interdisciplinary process studies at locations that are characterized by different combinations of fundamental transport processes will provide significant new information to advance our understanding of coastal oceans and be applicable to continental margins around the world. Coupled interdisciplinary process studies and modeling are the core of CoOP research programs. The specific objectives of this project are to facilitate coordination and communications amongst the specific CoOP research projects and to direct the strategic planning activities for future CoOP research initiatives.

APPROACH

The CoOP research plan is to conduct process and modeling studies on shelves which differ in the dominant physical transport processes. CoOP studies thus attempt to isolate key processes that have some global generality and to study these in detail on margins where effects can be isolated with a maximum degree of confidence. The Management and Planning Office works to facilitate the infusion of emerging technologies, such as coastal observatories, into these observational programs to maximize their impacts. Modeling studies are integrated with the process studies and used to synthesize and generalize study results. CoOP initially proposed to study five general categories of cross-shelf transport: wind-driven, tidally-driven, buoyancy-driven and western boundary current-driven transport and transport on seasonally ice-covered shelves.

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14. ABSTRACT
The goal of CoOP is to advance our quantitative understanding of the processes and interactions among the processes that determine the characteristics of coastal systems including the cross-shelf transports, transformations and fates of biologically, chemically and geologically important materials. The CoOP Program implements multi-investigator, interdisciplinary research in the coastal ocean which encompasses the disciplines of Biological, Chemical, Geological and Physical Oceanography plus Marine Meteorology.

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WORK COMPLETED

Completed Projects:
Thus far, CoOP has initiated six major programs, supporting over 110 individual researchers. The first two CoOP Projects (air-sea gas exchange and near-shore larval transport) were relatively small three-year efforts with modest numbers of Principal Investigators (8 and 15, respectively). The larval transport project conducted intensive, month-long field programs in August and October of 1994 at Duck, North Carolina. The air-sea gas exchange project conducted their field program in 1995 in coordination with the ONR-sponsored Marine Boundary Layer Research Initiative. CoOP investigators studied the air-sea exchange of carbon dioxide, dimethylsulfide, oxygen and noble gases. Descriptions of these early projects and resulting publications are listed on the CoOP website at http://www.skio.peachnet.edu/projs.html.

Subsequent projects have been larger, more interdisciplinary efforts. Studies of episodic, cross-margin transport events in the Great Lakes were initiated in 1997. The Keweenaw Interdisciplinary Transport in Superior (KITES) Project involves 16 P.I.s while the Episodic Events- Great Lakes Experiment (EEGLE) Project includes 30 P.I.s. The KITES Project is examining the exchange across the strong coastal current that forms along the Keweenaw Peninsula during the spring transition while the EEGLE Project is studying transport associated with spring-time wind events in Lake Michigan. A special issue of *the Journal of Geophysical Research* is underway, with more than 30 manuscripts submitted from both projects (manuscripts listed at http://www.glerl.noaa.gov/eegle/products/jgr_special_issue.html). A special issue of *the Journal of Great Lakes Research* is also planned, as well as a synthesis volume which will be published in the AGU monograph series.

Projects Currently Underway:

Two research projects along the Oregon and California coasts were initiated in 2000 to examine margin processes in locations where wind transport is a dominant forcing factor. The Coastal Advances in Shelf Transport (COAST) Project supports 18 P.I.s and is studying biogeochemical cycling at two locations on the Oregon coast that differ significantly in bottom topography. The Wind Events in Shelf Transport (WEST) Project supports 11 P.I.s and is focused on the relationship between wind-driven upwelling strength and biological productivity on the Northern California Shelf. Examples of highlights from both programs are displayed in Figures 1 and 2.

RESULTS

The four projects organized a special session (OS3) at Ocean Sciences 2002, with 48 oral presentations and 29 posters contributed. In addition to the brief updates posted on the CoOP website, all four projects maintain web sites where additional information can be obtained:

KITES: http://chmac2.chem.mtu.edu/

EEGLE: http://www.glerl.noaa.gov/eegle/

COAST: http://damp.oce.orst.edu/coast/

WEST: http://ccs.ucsd.edu/coop/west/

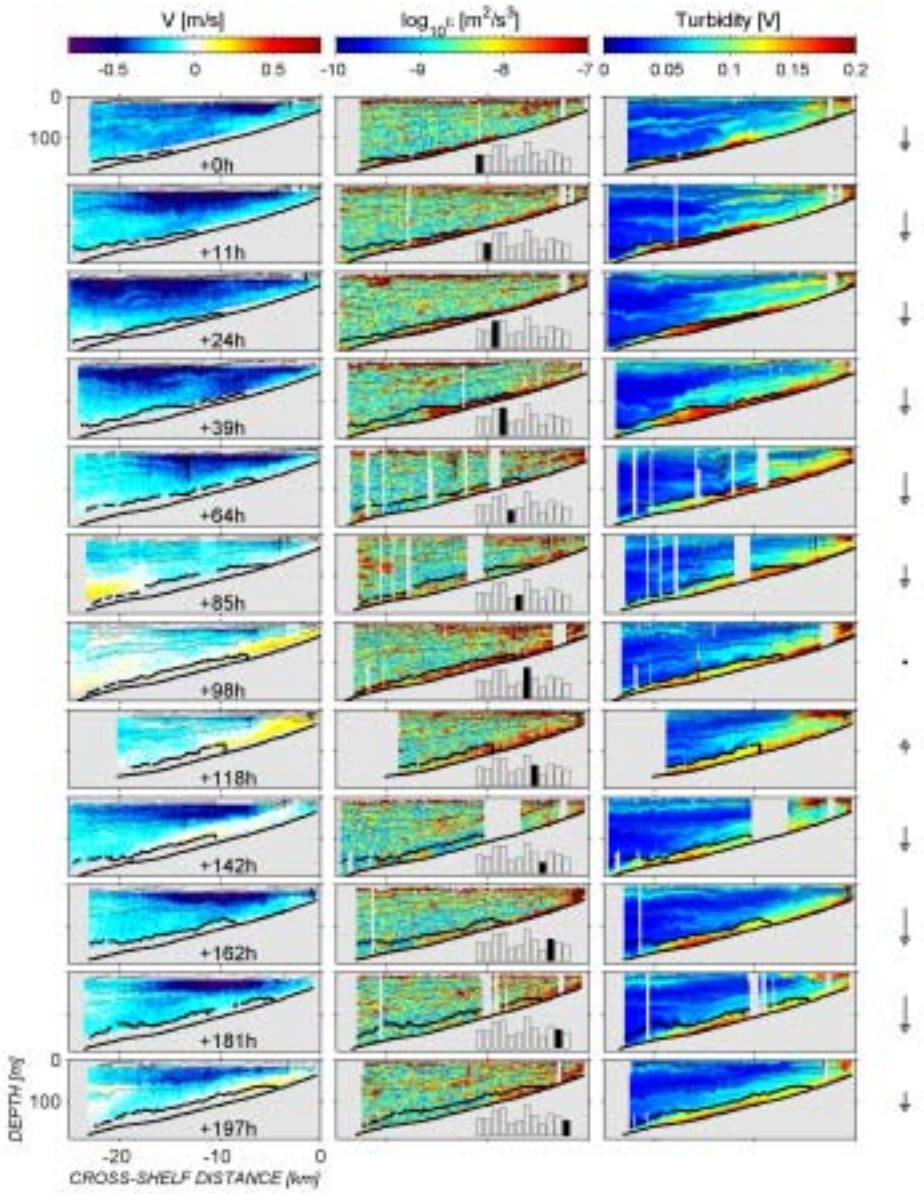

Figure 1. Summary of alongshore currents (V; lefthand column), turbulent dissipation rate (ε; middle column) and turbidity (from 880 nm optical backscatter measurements; right column) from an 8 day period in May/June 2001 during which 12 transects were made across the shelf off Cascade Head. Isopycnals are plotted over each image, the 26.6 isopycnal highlighted as an indicator of cross-shelf motion of the bottom boundary layer. Relative wind stress averaged over 24 h period preceding each transect is shown to the right (upwelling-favorable down). The relative time of each transect is shown in the leftmost column, starting with 0 h at the beginning of the first transect. In the lower right hand corner of the ε image plot is shown the transect-averaged dissipation (units of W per m of alongshore distance linearly scaled from 0 – 150); the highlighted bar represents the current transect. The rapid response of the system and off-shore motions in response to the onset of downwelling favorable conditions is clear.

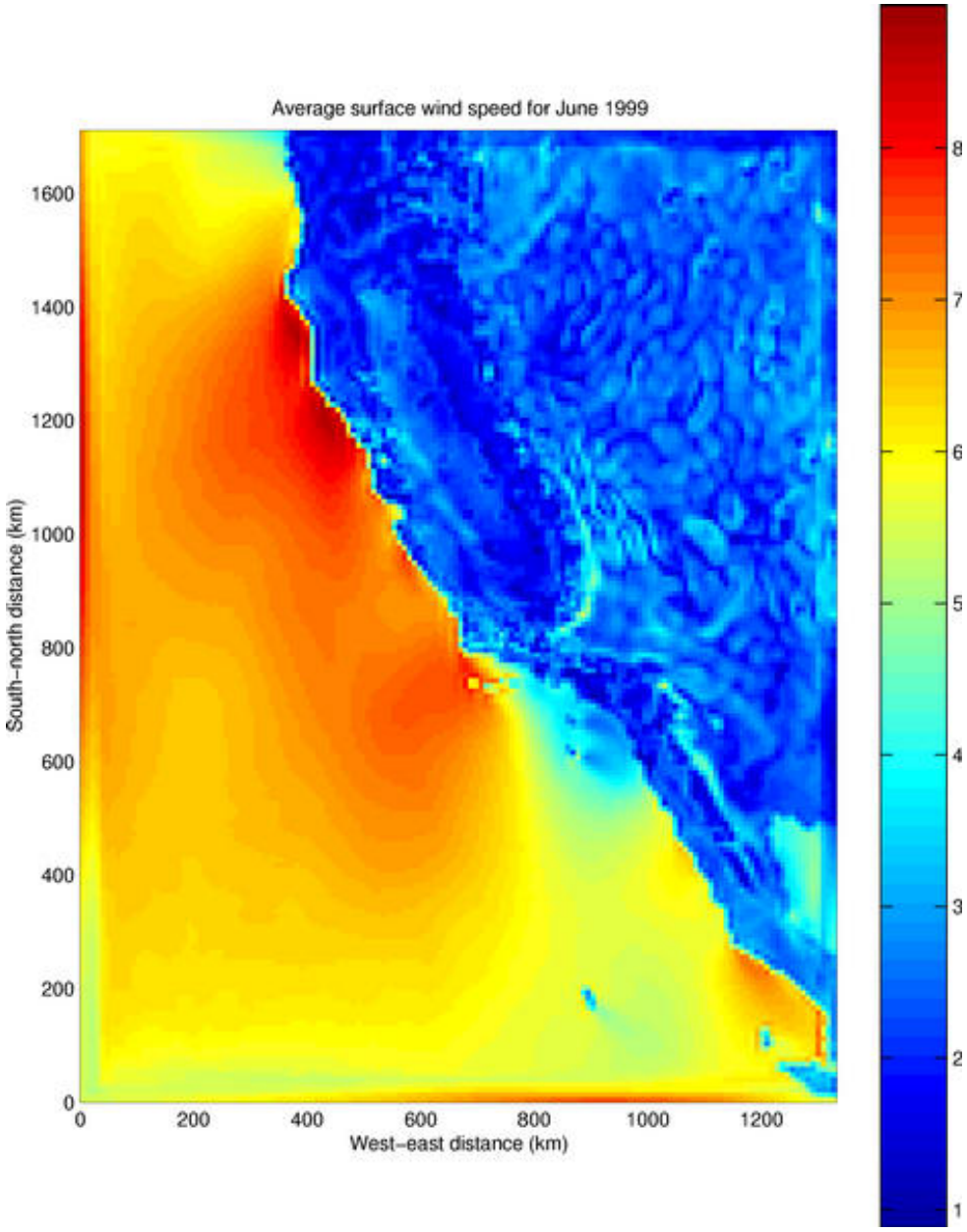

Figure 2. MM5 simulated surface wind as averaged for June 1999. Large scale models of atmospheric circulation and winds generally do not have sufficient resolution to resolve the coastal interface, coastal topography and coastal sea-surface temperature gradients. Regional and mesoscale models generally have sufficient resolution but generally lack accurate boundary and initial conditions. High resolution measurements throughout the simulation period and being assimilated into the MM5 model to reproduce the hydraulic nature of the marine layer. Features evident in the simulation are wind speed maxima in the lee of coastal topographic features with weak winds in the upwind side.

FUTURE EFFORTS

Study of Shelf Systems Impacted by Freshwater Discharge

In 1998, CoOP held a workshop devoted to articulating science questions focused on shelf systems where buoyancy is a primary factor controlling ecosystem structure, biogeochemical cycling and material transport. To augment the results of this workshop, the CoOP Program also solicited proposals to write review papers covering regional and process-oriented aspects of coastal systems impacted by buoyancy and biological and chemical effects related to significant freshwater inputs. The successful proposals supported 16 P.I.s and the resulting manuscripts are currently being reviewed for publication in *Continental Shelf Research*. Based on the workshop report and review manuscripts, an Announcement of Opportunity was developed and released by NSF in December 2001 for studies of shelf systems impacted by freshwater input. The Program Announcement closed on 24 July 2002, with interdisciplinary and/or individual proposal submissions received for both the US East and West coasts and the Gulfs of Alaska and Mexico. The proposals are currently in review and the review panel is scheduled to meet in late October 2002. It is anticipated that funding will begin in early 2003 for the selected submissions and will comprise the next major research effort of the CoOP Program.

Planning for Coastal Observatories

To assist the coastal research community in the development of coastal observatories, the CoOP Program sponsored a workshop in May 2002 in Savannah, Georgia. The 2.5 day workshop included an assessment and prioritization of coastal research issues; a review of existing observatory systems; development of a list of critical hypotheses, questions and processes; consideration of the necessary attributes of coastal ocean observatories; and recommendations for the optimum way to implement coastal ocean observatories.

The workshop organizing committee (OC) consisted of the CoOP Chair and four members of the CoOP Scientific Steering Committee, a representative for Ocean.US, and four additional scientists selected for disciplinary expertise and regional representation. Participation in the workshop was solicited by direct invitation and travel support for 30 scientists selected by consensus of the OC for their perspective, disciplinary and regional representation. The coastal science community at large was encouraged to attend via advertisements placed in EOS and on Oceansp@ce, Ocean.US and other electronic bulletin boards. A total of 65 scientists representing 36 universities, government agencies and other institutions participated in this workshop.

The overall consensus of workshop participants was that ocean observatories represent a fundamentally new enabling technology that will permit future research efforts to examine processes on space and time scales not previously achievable. This includes sustained measurements at multiple locations to develop synoptic time-series observations of large-scale phenomena and sustained high frequency measurements to examine short-duration and rare events. Real-time data reporting also greatly expands research opportunities by supporting remotely-controlled and targeted sampling efforts. The technological capabilities afforded by coastal observatories such as high bandwidth, two-way communication and substantial power for measurement systems will provide unprecedented access to the sea and enhance scientific inquiry by providing continuous, long-term measurements of oceanographic and atmospheric quantities. The development of critical technologies in communications, power, robotics, and ocean engineering will facilitate infrastructural changes that will

gradually rival and in some instances displace ships as the main observational platforms for studying ocean processes. Additionally, the data management framework, which is envisioned to unite the national C-IOOS backbone, will greatly facilitate and expand coastal research efforts.